




PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

To:

see form PCT/ISA/220

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY
(PCT Rule 43bis.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/US2004/029426

International filing date (day/month/year)
08.09.2004

Priority date (day/month/year)
17.09.2003

International Patent Classification (IPC) or both national classification and IPC
G11C16/34, G11C16/04

Applicant
SANDISK CORPORATION

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement.
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

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Form (PCT/ISA/237) (Cover Sheet) (January 2004)

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**International application No.
PCT/US2004/029426**Box No. I Basis of the opinion**

1. With regard to the language, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
 - ☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material:
 - ☐ in written format
 - ☐ in computer readable form
 - c. time of filing/furnishing:
 - ☐ contained in the international application as filed.
 - ☐ filed together with the international application in computer readable form.
 - ☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

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Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	14
	No: Claims	1,15
Inventive step (IS)	Yes: Claims	14
	No: Claims	2-13,15-30
Industrial applicability (IA)	Yes: Claims	1-30
	No: Claims	

2. Citations and explanations

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

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AUTHORITY (SEPARATE SHEET)**

International application No.

PCT/US2004/029426**RE SECTION V**

1. The following document is considered to be relevant:

D1: US-A-6 011 287 (ITOH YASUO ET AL) 4 January 2000 (2000-01-04)

2. From the document D1 there is known (cf figs.6,7 and col.7, l.22-67) a non-volatile memory of the NAND-type (cf eg NAND-chain in fig.1B) wherein programming of designated memory cells (fig.6A: STATE A) is made by applying a first voltage (0V) to the bit lines (BL1) of the designated memory cells to enable programming, and a second voltage (3.3V) to the bit lines (BL2) of undesigned memory cells (STATE B) to inhibit programming. Upon application of a programming pulse ($V_{pgm}=18V$) to the control gate of the designated memory cell, a potential difference of 11V (cf col.7, l.7-9) appears between the floating gate and the channel which is sufficient for programming said designated memory cell. At the same time, said programming pulse ($V_{pgm}=18V$) is also applied to the control gate of the undesigned memory cell which leads to a potential difference of 3V (cf col.7, l.63-65) between the floating gate and the channel which is insufficient for programming said undesigned memory cell. The latter potential difference of 3V is the result a self-boosting effect, namely the result of capacitive coupling of the control gate and the channel of the undesigned memory cell, which boosted the program-inhibited bit line (BL2) from the second voltage to a third voltage (8V, cf fig.6C and col.7, l.47-49).
3. D1 does not explicitly deal with further influences effected by having the program-inhibited bit line boosted to the third voltage. However, it is clear from physical reasons that there is also a capacitive coupling between adjacent bit lines. In view that the program-enabled (BL1) and program-inhibited (BL2) bit lines as well as the channels of the memory cells are floating (gate SG2 is "off" and the further transistors in the NAND-chain are "on", cf col. 7, l.40-45), the third voltage on the program-inhibited bit line increases the potential on the program-enabled bit line by a certain portion which portion decreases the voltage difference between control gate and channel of the designated memory cell and therefore acts as an offset for said voltage difference.

Due to this reduced voltage difference, however, the same effect as desired by

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the present application is automatically obtained, namely that overprogramming of a designated memory cell due to the presence of adjacent programmed memory cells is avoided (cf eg [0066]).

4. When comparing independent method claim 1 and the apparatus counterpart claim 15 with D1, it is noted that all features of said claims are anticipated by D1.

Hence, claim 1 and 15 do not meet the requirement of novelty.

5. Among the features of the further claims, only the particularity of claim 14 is considered to go beyond that what is known or suggested from D1 or from D1 in combination with common technical knowledge, namely the particularity that a program-enabled bit line is set to ground whenever it has two neighboring bit lines which are also program-enabled.

RE SECTION VII

1. The independent claims are not drafted in two part form with the closest prior art (D1) taken into account in the respective first parts.
2. The claims are not provided with reference signs.
3. The introduction of the description does not acknowledge the relevant prior art as known from D1.

RE SECTION VIII

1. The present set of claims comprises 1 independent method claim (claim 1) and 2 independent apparatus claims (claims 15,18). Independent claim 18 comprises the features of claim 1 and adds further features relating to the provision of a controller and a power supply. These further features render unclear what features are in fact essential to the invention. Consequently, said claims do not meet the requirement of conciseness (Art.6, PCT). In the present case, only one independent claim per category can be considered to be justified.
2. Claim 13 is unclear because it only defines an object, namely to set the program-

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enabled bit line to a potential that substantially maximises programming efficiency. Without the feature of claim 14, namely that this potential is ground, it is obscure in claim 13 which value of the potential could solve the object.